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182. Proposed by A. H. HOLMES, Brunswick, Maine.

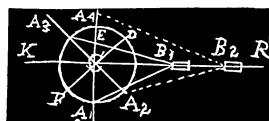
$$\text{Evaluate } \int_0^{\frac{1}{2}\pi} d\theta \sqrt{[1 + \sin^2 \theta(1 - 4\cos \theta)]}.$$

MECHANICS.

170. Proposed by ELISHA S. LOOMIS, Berea, Ohio.

Two angles of iron, A_1CD and A_1CA_3 , move freely on a pivot at C . Rods B_1A_1 and B_2A_3 are attached respectively at A_1 and at some point A_3 , so that when B_1 moves along the rod CR , which is perpendicular to A_1A_4 , CD and CA_3 shall coincide in position with CE which is perpendicular to rod KR . When angle A_1CD is 135° find CA_3 in terms of CA_1 .

Also find the following:



1. That value of CB_1 which will require least effort exerted at B_1 to cause CA_3 to take the position CA_4 .
2. That value of CB_1 which will cause B_2A_2 , if produced, to pass through the point A_1 .
3. As CB_1 varies in value, what is the locus of the intersection of A_1B_1 and A_2B_2 ? Of B_1A_3 and B_2A_4 ?
4. Suppose angle A_1CD to be any other angle than 135° , then find CA_3 in terms of CA_1 .

GROUP THEORY.

5. Proposed by L. E. DICKSON, Ph. D., The University of Chicago.

In lieu of the incorrect developments of Burnside, *Theory of Groups*, pp. 56-58, show that an Abelian group of type (m_1, m_2, \dots, m_r) , $m_1 \bar{>} m_2 \bar{>} \dots \bar{>} m_r$, has a subgroup of type (n_1, n_2, \dots, n_s) , $n_1 \bar{>} n_2 \bar{>} \dots \bar{>} n_s$, if and only if $s \leq r$, $n_i \bar{<} m_i$ ($i=1, \dots, s$).

MISCELLANEOUS.

145. Proposed by H. F. MacNEISH, Chicago, Ill.

Two complete 5-plane configurations in space having the same vertices are identical; in general two complete $(n+2)$ -faces in n -space having the same vertices are identical.

NOTES.

Dr. H. L. Rietz has been promoted to an assistant professorship at the University of Illinois.